

TC Installation Overview (WBS 1.10)



TC Activities (US View)

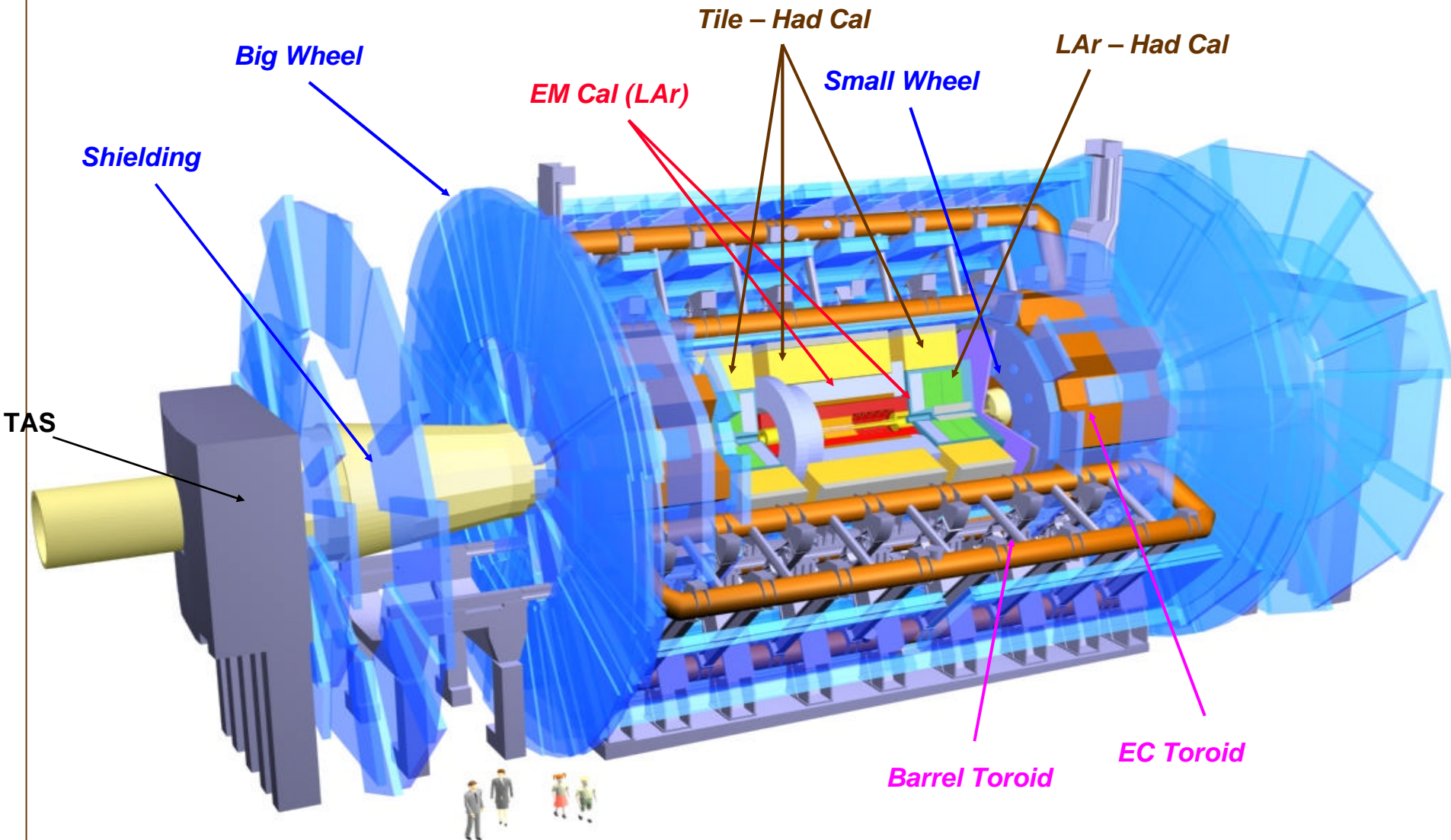
- ***TC Organization***
- ***TC Activities (Emphasis on US Involvement)***

TC Installation Overview & Schedule (& Effect on US Program)

- ***Hall & Infrastructure***
- ***Feet& Rails***
- ***Barrel Toroid***
- ***Barrel Calorimeter***
- ***EC Calorimeter***
- ***Barrel Muons***
- ***ID***
 - ***TRT/SCT Barrel***
 - ***TRT EC***
 - ***Pixel/Beam Pipe***
- ***EC Muons – SW / BW***
- ***EC Toroid***

Conclusions

The ATLAS Experiment



US Involvement in ATLAS TC



Objective: Strengthen TC and ATLAS Central Management.

- Project management Functions.

Oversight over Subsystems.

Ability to set priorities and shift resources.

- Integrations.

Configuration Control.

Installation.

Access.

- Detector on "day One."

Assuming not all parts of ATLAS will be there what can we expect as a "day one" detector.

Installation studies.

- ◆ M. Nessi elected as the new ATLAS Technical Coordinator spring '01.
- ◆ US Involvement started early '01.
- ◆ M. Nessi "new TC" organization take place – D. Lissauer Activity A manager.
- ◆ US Contributions aim at optimizing resources –
 - US expertise
 - More flexibility in funding.

ATLAS Technical Coordination Organization



*[spokesperson
deputy spokesperson
resources co-ordinator
technical co-ordinator]*

**ATLAS
management**

TMB
*(Technical Management
Board)*
chairperson: M. Nessi

*[activity managers,
ATLAS management]*

activities

**B) CERN Divisional
Relations.**
P.Schmid

**D) Electronics and
Signal processing**
Ph. Farhouat

**F) Integration &
Installation**
M. Hatch/G. Tappern

H) Commissioning

**A) TC Project
Office.**
D. Lissauer

**C) Systems
Construction Liaison**
M. Nessi (Acting)

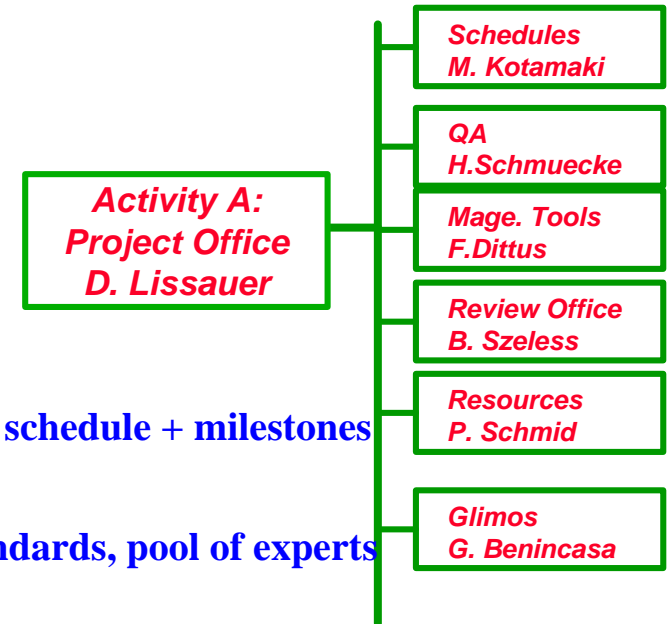
E) Common systems
M. Nessi (Acting)

**G) Logistics +
experimental areas**
J. Inigo-Golfin

TC Project Office



*support the Technical Coordinator in organization,
project tracking , Reviews .*



Schedules + Milestones: Central organization, follow-up the master schedule + milestones

Reviews office: Coordinate the review Process, prepare standards, pool of experts

Management Tools: PPT, EDMS, MS-Project etc.

CDD support + follow-up (all drawings in the system + electronics)

Resources: Monitor of the resources needed to accomplish the various TC tasks

GLIMOS: Glimos representative of ATLAS

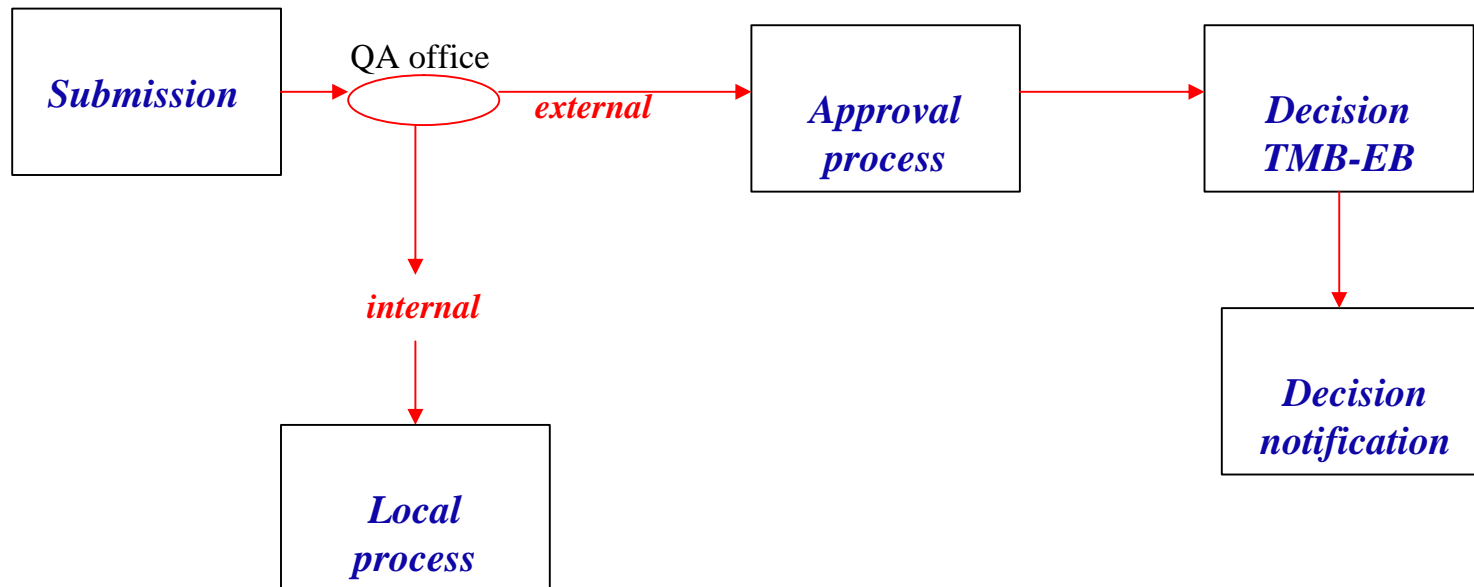
QA : Coordinate the QA activity in ATLAS – help in review.

One of the responsibilities is handling of changes in the project description via a formal:

ECR : engineering change request

In the last year a baseline has been established. (with some known conflicts)

We have established the method and tools for ECRS



Management Tools



encouraged use of Management tools by making them “user friendly”:

- **WWW pages** : *TC uniform approach (TMB Agenda and talks, Access to needed information)*
- **EDMS** : *storage and approval of documentation/drawings*
- **PPT** : *project progress tracking system*
(All systems are using it over 1000 reports /month)

New effort installation database:

- **LHC is going to be treated as a Nuclear Installation. All materials need to be tracked.**
- **Same technology adopted by the LHC machine.**
- **Extension of the same data base will be used as input for the information needed for installation of ATLAS services. (ST Division)**

MP5 and e-traveler concept : K. Pommès & F.Ditus

Student from Nevis for a Year to work on Data Base. (Mathew Sharp)

Management Tools



*All Tools are Accessible
on the WEB.*

ATLAS TC Documentation Center

Tools

PPT Project	◆ Instructions
Progress	◆ Login
Tracking	◆ More

EDMS

Engineering
Data
Management
System

Documents
◆ Instructions
◆ Login
◆ More
Drawings - CDD
◆ Instructions
◆ Login
◆ Guided Search
Electronics
◆ Instructions
◆ Login
◆ More

Configuration Control

Quality

- ◆ [Quality Plan](#)
- ◆ [Engineering Change](#)
- ◆ [Help & Guidelines](#)
- ◆ [ECR in progress](#)
- ◆ [ECR closed](#)

Schedule

- ◆ [PPT & Schedule](#)
- ◆ [Status summary](#)
- ◆ [Baseline Schedule](#)

Safety

- ◆ [System Safety](#)

Electronics

- ◆ [Co-ordination](#)

Mechanics

- ◆ [Baseline Envelopes](#)

Reviews

- ◆ [TC Reviews](#)

TC Organization

Activities

- ◆ [TC Organization](#)
- ◆ [TMB](#)
- ◆ [A :TC Project Office](#)
- ◆ [B:Cern Divisional Relations](#)
- ◆ [C:Detector Construction Liaison](#)
- ◆ [D:Electronics & Signal Processing](#)
- ◆ [E:Common Systems](#)
- ◆ [F:Integration & Installation](#)
- ◆ [G:Logistics & Experimental Areas](#)
- ◆ [H:Commissioning](#)

Review Office



**Organize to help monitor the various parts of the project
(Technical Status and schedule):**

- **System reviews: DR, FDR,.... organized at the system or subsystem level → a lot of requests for TC help**
- **Mandatory reviews:**
 - ◆ **PRR :** Readiness review as a formal green light to start procurement or construction work
 - ◆ **PAR :** Advancement review as formal check of the correct implementation of the production process
 - ◆ **ASSO :** System overview to look at the
 - way the system operates internally
 - to have a picture once in time of the coherence of all activities and their link
 - to clarify the status of the interfaces with the rest of ATLAS

INTEGRATION AND INSTALLATION

Integration and Installation : (Mark Hatch, Geoff Tappern)

F) integration and Installation

M. Hatch:

- A) Configuration control : (sub)system envelops and dimensions, baseline layout, installation drawings , installation schedules , interference and integration (system space allocation), prepare change control documentation
- conflicts
- Services : organization of all services, cables layout + installation, common procurements
 - Safety experimental : persons and material safety organization inside the ATLAS area (for GLIMOS functions report direct to TC)
 - Infrastructure : organization of all infrastructure and tooling for installation and access
e.g. Cooling of electronics.

G. Tappern:

- B)
- (sub)system installation : overall installation plan, (sub)system installation follow-up and overview
1 installation Project Leader / (sub)system + Deputy + installation team
 - Survey and alignment : organization and execution of all survey and alignment jobs
 - Technical support : organization of a central installation team + its infrastructure

Configuration
control / Space

Services

Safety

Infrastructure

Subsystems
installation

Survey and
alignments

Technical
support

Opening and
Access

Configuration control & Mechanical Integration



- **ATLAS baseline :** - **definition of envelopes :**

Significant changes in Envelopes :

Big Wheel

Gap has increased by 40 mm

Under consideration: Move Barrel Toroid inner radius by 25 mm.

- **Handling of all changes from now on via ECR**
- **Creation of an ATLAS official database for all 3-D CAD models being used to study integration and installation**

Starting in '01 an large amount of work has been done by a small team of people under Olaf Beltramello.

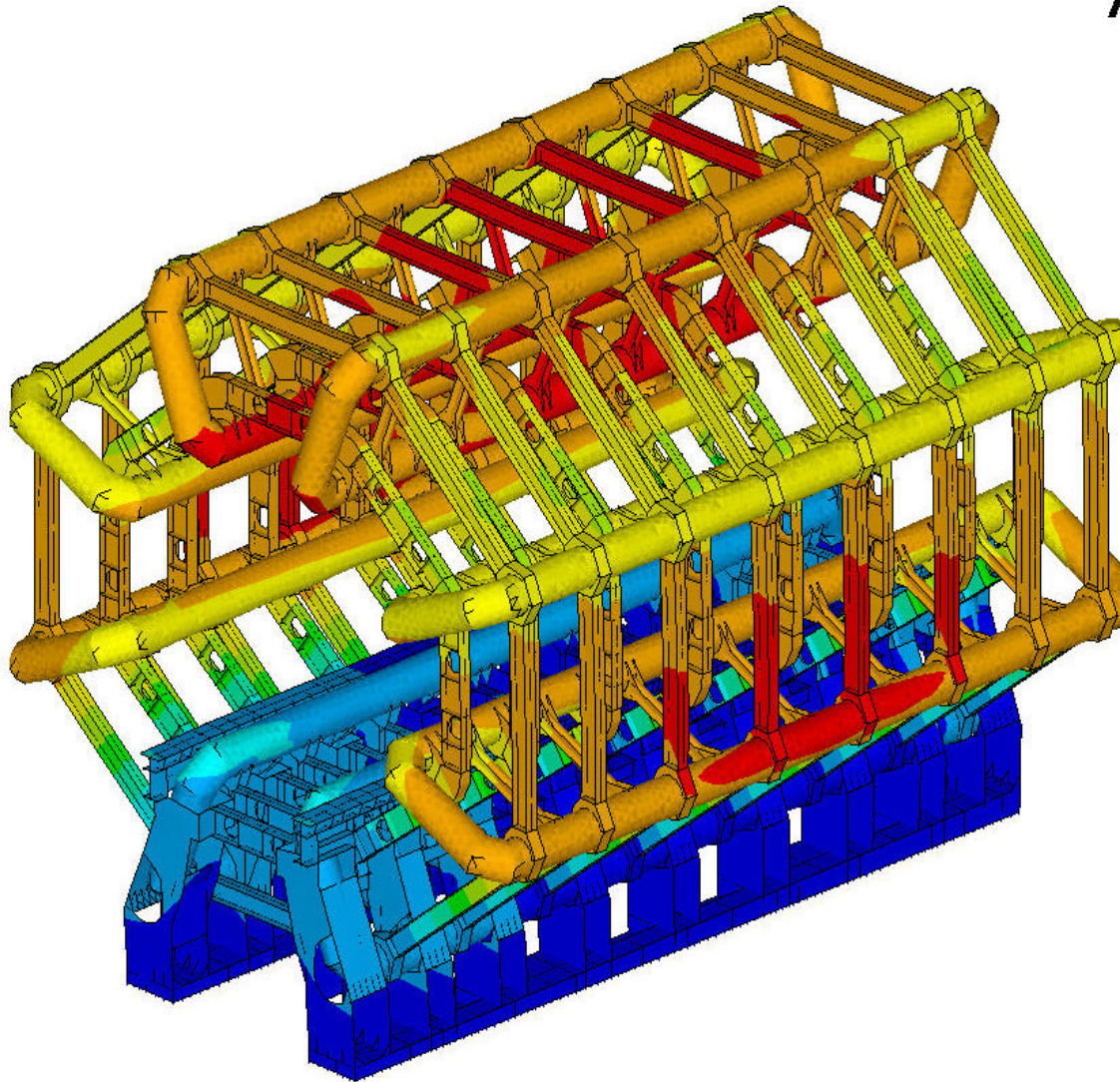
US contribution was critical. We have two senior Cad Designers working in this team.

Senior CAD designer T. Klioutchnikova: (@ CERN)

Senior CAD designer S. Norton: (@ BNL)

Mechanical Integration

ANSYS



FEA Calculations
Mechanical Integrity.

Assembly Studies

**e.g. Toroid needs to be
assembled Elliptical” so
that when load is release
structure will become
Circular.**

ATLAS-CERN

**Mechanical Integration
Group.**

Installation – Access Studies



**Access is a challenge
in ATLAS.**

- **Geometry.**
 - **Activation.**
 - **Electronics on
Detector.**
-
- **ACCESS STUDIES**
 - **FIXED STRUCTURES**

**Anatoli Grodeev(BNL) – with
Geoff Tappern/Tommi Nymann
Access Scenarios and tooling**

Title:

D:\drawing start from 02-12-01\integration\Access drawings\Access proposal 01-22-02\Definitions\transfer-to-dxf\1a-JD-ENDCAP-access-difinition-5-06

Creator:

AutoCAD PSOUT

Preview:

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with a preview included in it.

Comment:

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PostScript printer, but not to
other types of printers.

Installation -Movement Studies

Specifications are tight.

e.g. EC Cal and Beam pipe

Move together.

Design of the Guides and

Support for:

X -Movements

Y -movements

Z -movements

ANL team taking a

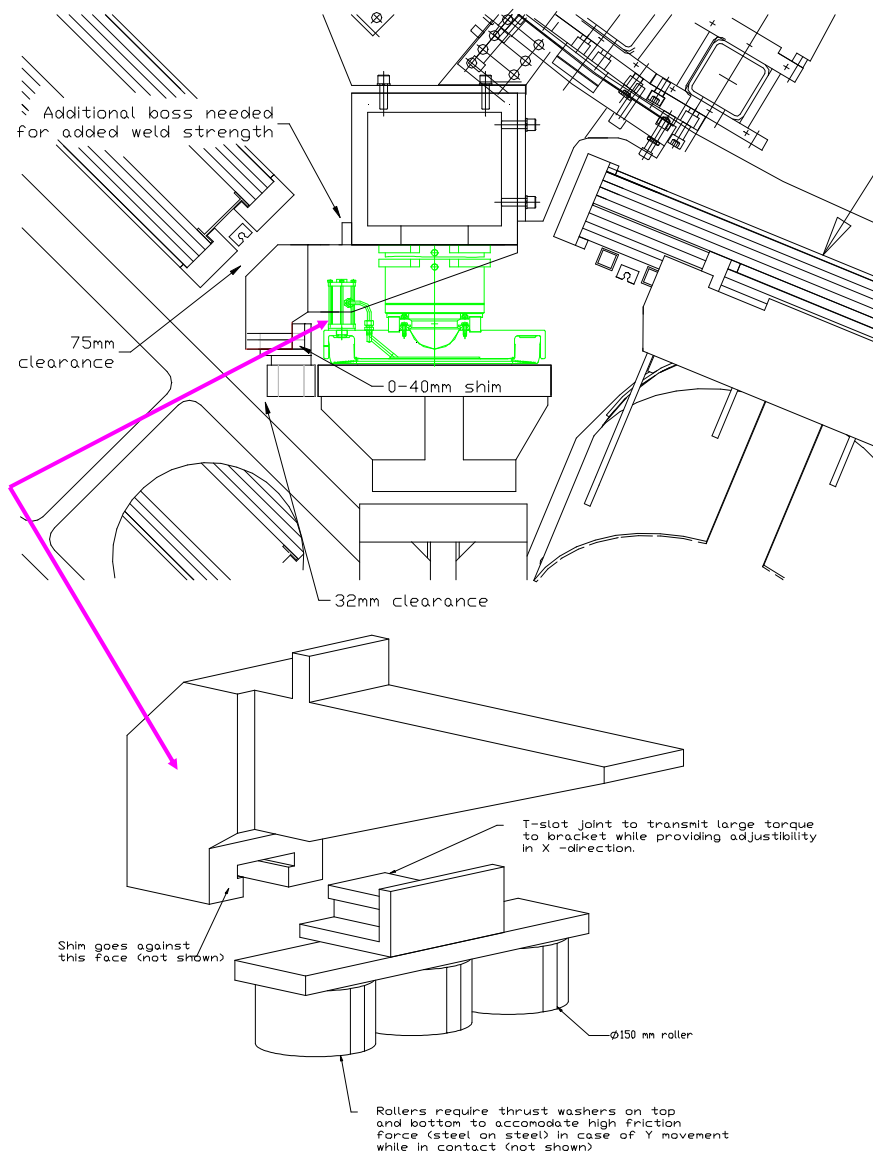
leading role in this study.

Building on their work on the

design and FEA calculations

for the EC calorimeter.

**X-Guide for
EC Cal.**



Pixel Tube /Beam Pipe Support

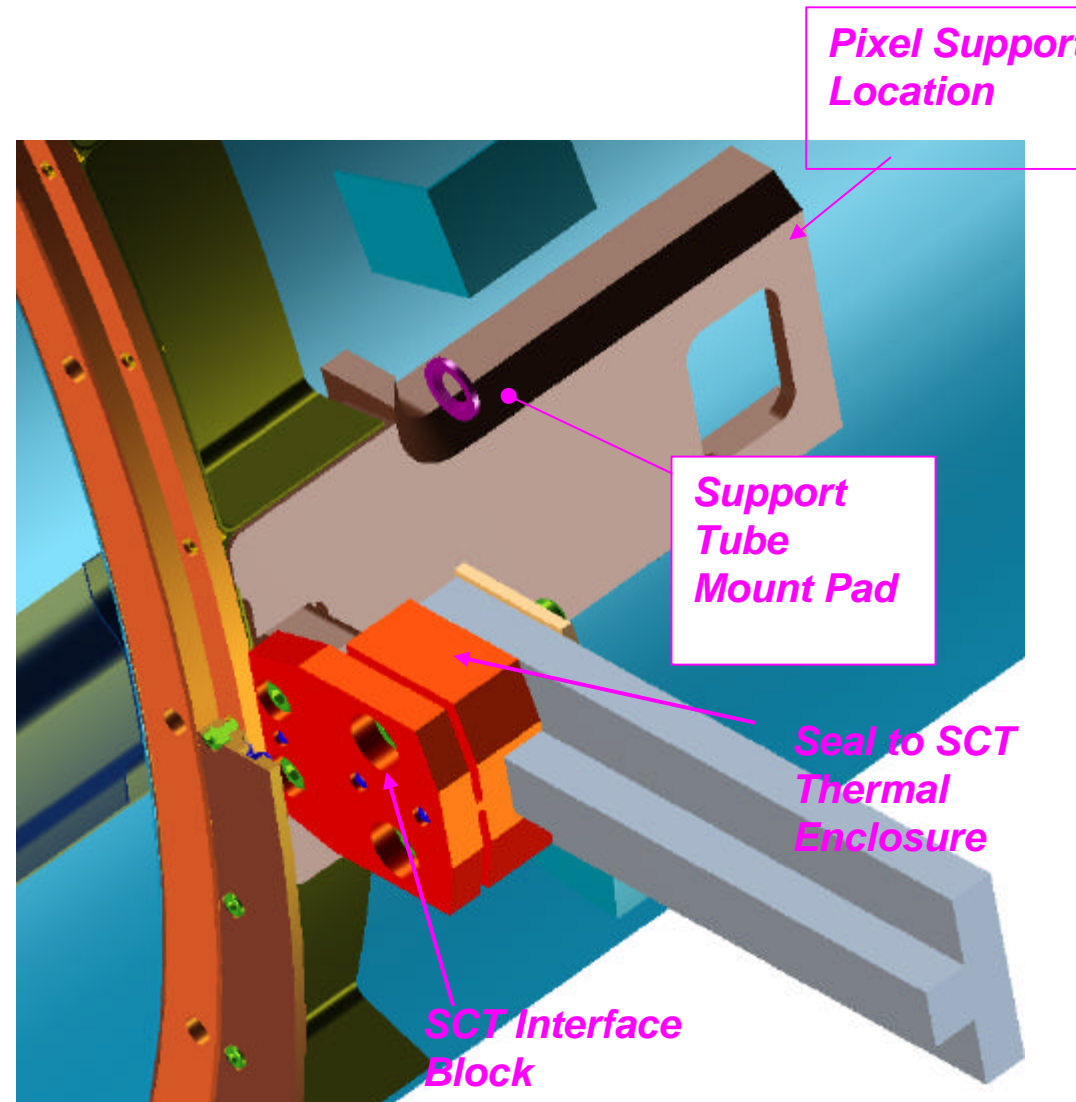
New Concept for Pixel/Beam Pipe Installations.

Building on LBL work on Pixel Support tube and Pixel installation work.

Additional responsibility for the Beam Pipe installation and support off the "Pixel" Tube.

(E. Anderson et al.)

SCT/Pixel interface areas



e.g. Major Changes -



- GAP Task Force:** Increase the GAP between the Barrel and EC by ~40 mm.
32 mm for ID services, increase in stay clear area.
****Move ID Patch Panels behind Muon Chambers layer 1*
- Z/R Envelopes:** Increase all the Stay Clear Areas between moving systems.
Big Wheel Envelopes, Toroid Inner Radius.
**** ECR in process to increase Toroid Nominal by 25 mm*
- Shielding:** Major Changes in the shielding configuration.
Simplification in design and major weight reduction with no loss of performance.
****New Design for the Forward Shield. Major Cost saving*
- New Pixel/Beam installation scenario:**
Pixel and Beam pipe will be installed as an “package”
B- layer will be installed only during “long Access” Configuration
*****ECR in Progress*
- Beam Pipe Double or Single Wall:**
Ongoing investigation to determine if we can live with a single wall beam pipe both in the Beryllium part and in the Beam Pipe going through the EC Calorimeter.
***** Major cost saving, System simplification*

Objective – Simplify when possible with minimal effect on Physics.

US Contribution to TC



US Physicists Involved in TC:

- | | |
|---------------------|---|
| <i>D. Lissauer</i> | - TC Activity A, Placement Strategy (BNL) |
| <i>M. Shupe</i> | - Radiation/Activation Studies (Arizona) |
| <i>J. Bensinger</i> | - Forward Muon Integration (Brandies) |
| <i>B. Stanek</i> | - Movements (ANL) |
| <i>I. Stumer</i> | - Field Calculations (BNL) |

TC Support @ CERN:

- | | |
|--------------------------------|--|
| <i>K. Pommès</i> | <i>Project Management – Eng.</i> |
| <i>T. Klioutchnikova</i> | <i>Senior Designer – Conf. Control</i> |
| <i>Add. Eng. @ CERN</i> | <i>Services –</i> |
| <i>Mathew Sharp</i> | <i>Student – Data Base (July '02)</i> |
| BNL: <i>S. Norton</i> | <i>Senior Designer – Conf. Control</i> |
| <i>A. Gordeev</i> | <i>Engineer - Access</i> |
| ANL: <i>V. Guarino</i> | <i>Movements/FEA Calc.</i> |
| LBL: <i>E. Anderson</i> | <i>Pixel/Beam Interface.</i> |

Schedules & Milestones



A new installation schedule is under development.

new LHC Schedule Beam Injection April '07.

There are three main steps in the production/Installation sequence.

- 1. Production of components in outside institutions and or industry. (On going on most items)*
- 2. Assembly and commissioning in "Staging areas" @ CERN of large sections before final installation in the pit.*
- 3. Installation in the Pit.*

new Schedule Objective:

Start date unchanged (ASAP start Installation work)

Review installation tasks with the systems and update time estimates.

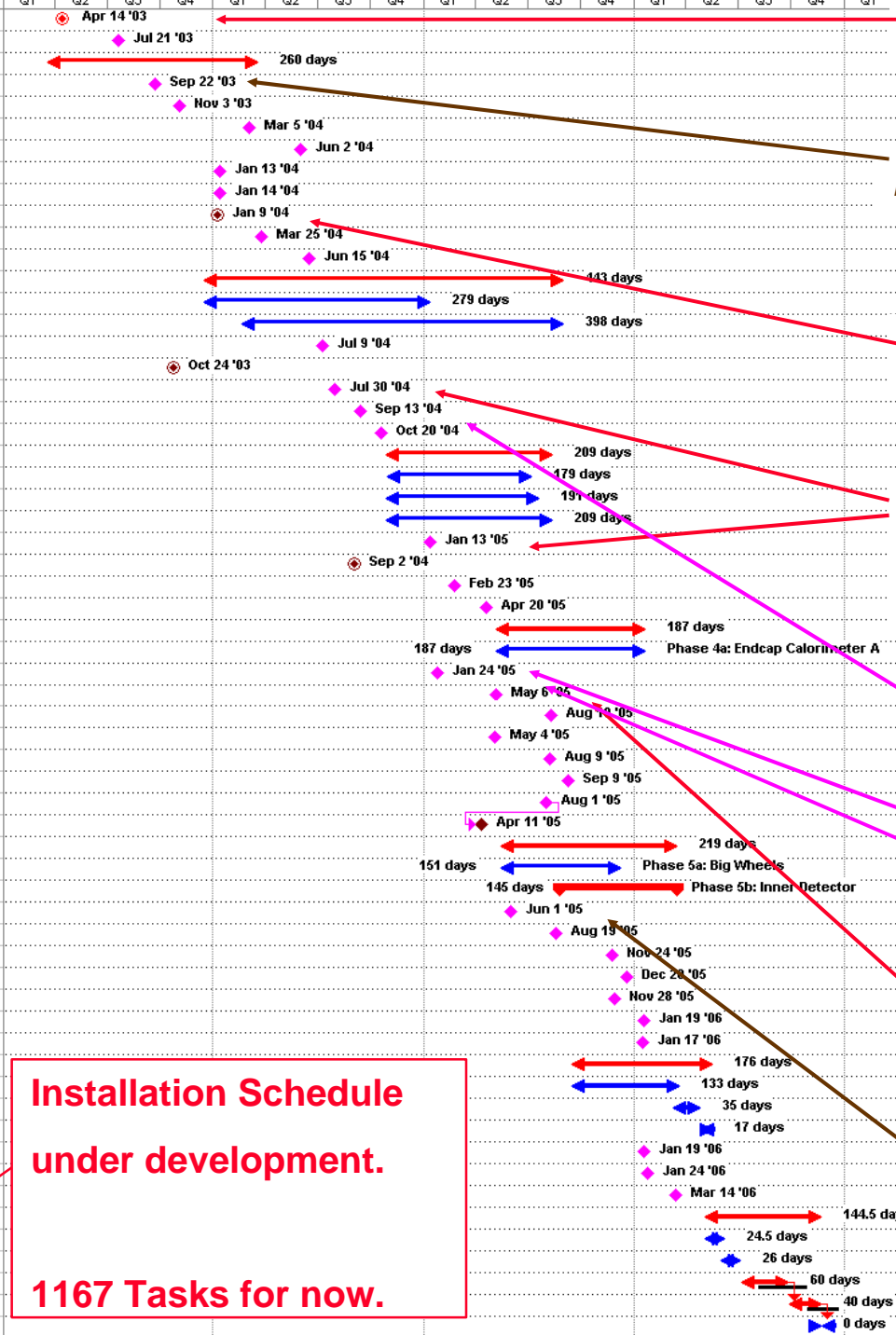
Re-establish a float four month (Min) for ready for installation milestones.

Include all major tasks in the installations schedule in particular testing and commissioning time

Review Services Installation tasks and update time needed.

Understand better what work can be done in parallel.

UX 15 Hand-over
 Feet and Bedplates Ready For Installation
PHASE 1: Infrastructure & Feet
 Toroid Barrel Coil 1 Ready For Installation
 HXT Structure Ready For Installation
 Toroid Barrel Coil 8 Ready For Installation
 Shielding nose mono-blocks Ready For Installation
 Fixed Truck (HFF) Ready For Installation
 Tile Barrel Ready For Installation
 LAr Barrel cold tests finished
 LAr Barrel Ready For Installation
 Chimney Ready For Installation
PHASE 2: Barrel Toroid & Barrel Calorimeter
Phase 2a: Barrel Toroid
Phase 2b: Barrel Calorimeter
 Tile Extended C Ready For Installation
 LAr ECC cold tests finished
 LAr End-Cap C Ready For Installation
 Muon Barrel Chambers side A Ready For Installation
 Muon Barrel Chambers side C Ready For Installation
PHASE 3: End-cap Calorimeter C & Muon Barrel
Phase 3a: Endcap Calorimeter C
Phase 3b: Inner Detector Services
Phase 3c: Muon Barrel
 Tile Extended A Ready For Installation
 LAr ECA cold tests finished
 LAr End-Cap A Ready For Installation
 Shield Discs Ready For Installation
PHASE 4: End-cap Calorimeter A
Phase 4a: Endcap Calorimeter A
 Big Wheels side C Ready For Installation
 Inner Detector Barrel Ready For Installation
 Shielding Nose washers Ready For Installation
 Big Wheels side A Ready For Installation
 ID Inner End-Cap C Ready For Installation
 ID Inner End-Cap A Ready For Installation
 ID Beam Pipe Ready For Installation
 Initial Pixel Detector Ready For Integration with VI
PHASE 5: Big Wheels & Inner Detector
Phase 5a: Big Wheels
Phase 5b: Inner Detector
 End-Cap Toroid C Ready For Installation
 End-Cap Toroid A Ready For Installation
 Fully Instrumented Small Wheel C Ready For Installation
 Toroid Shielding Ready For Installation
 Small Wheel A fully instrumented and Ready For Installation
 End wall chambers side C Ready For Installation
 End wall chambers side A Ready For Installation
PHASE 6: Toroid End-Caps & Small Wheels
Phase 6a: Endcap Toroid
Phase 6b: Small Wheels & Toroid Shielding (IT)
Phase 6c: End wall Chambers (EO)
 VT Beam Pipe Ready For Installation
 VJ Beam Pipe Ready For Installation
 Forward Shielding Ready For Installation
PHASE 7: Beam Vacuum, Closing, Shielding
Phase 7a: Completion of the Beam Vacuum
Phase 7b: Magnet test & Shielding
 Global Commissioning
 Cosmic Tests
 ATLAS Ready For Beam

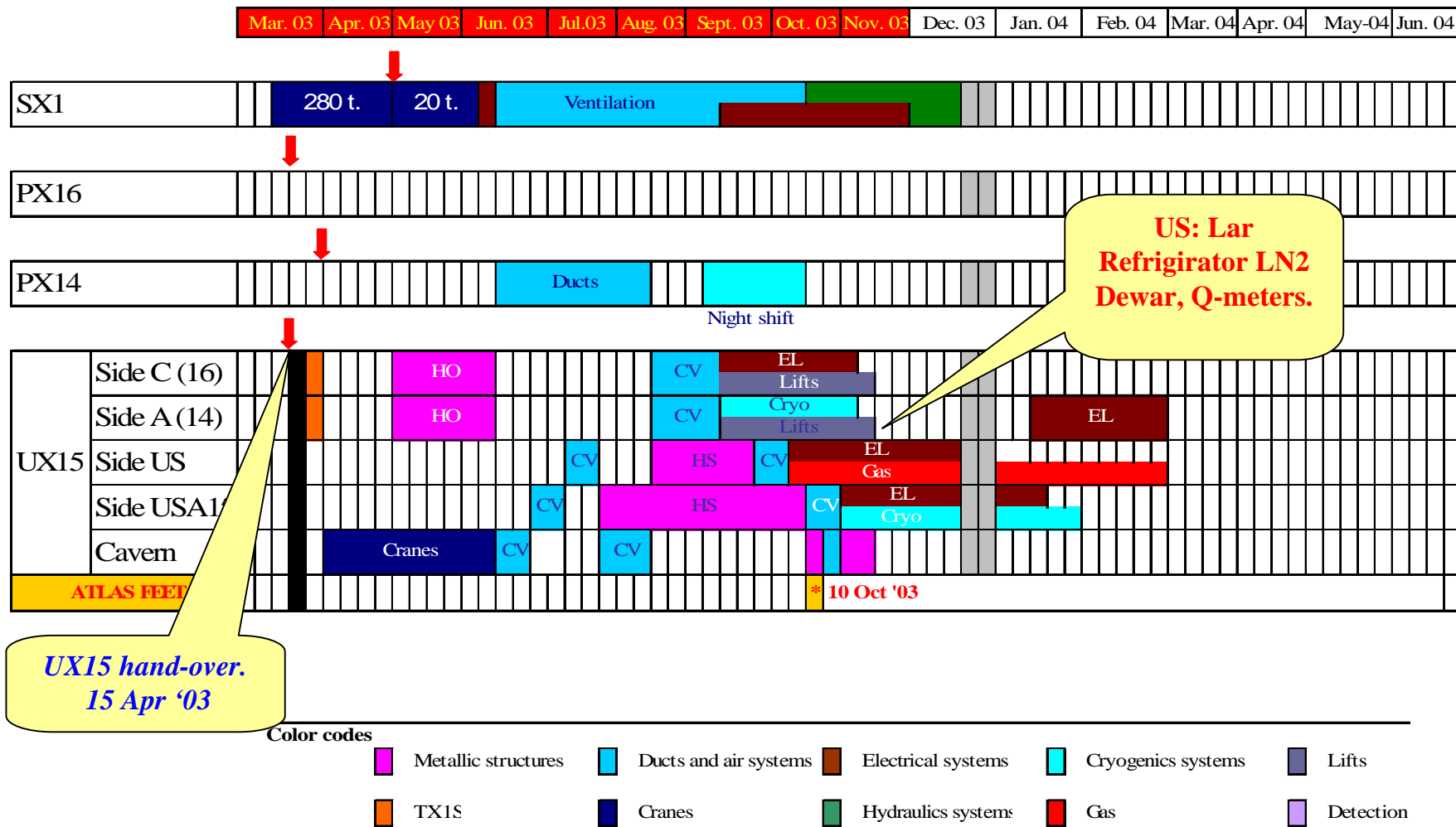


Hall - 3/03
Barrel Toroid 9/03
Barrel Cal 1/04
EC Cal EC-C 7/04
EC-A 1/05
Barrel Muons 9/04
SW/BW Muons Side C & A 1, 5/05
ID Barrel
TRT/SCT 5/05
EC Toroid 1/05



Installation Schedule
 under development.
 1167 Tasks for now.

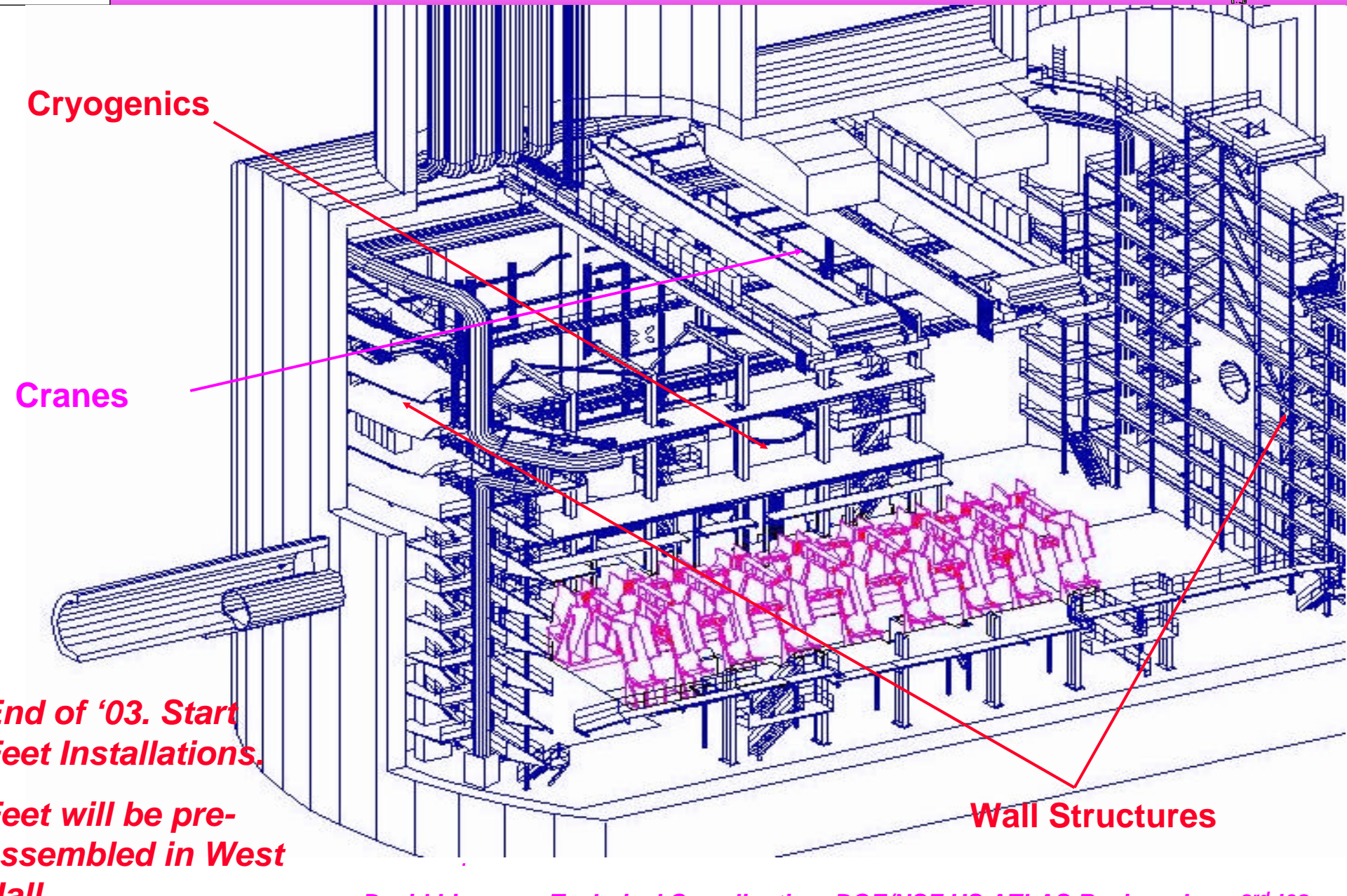
Infrastructure



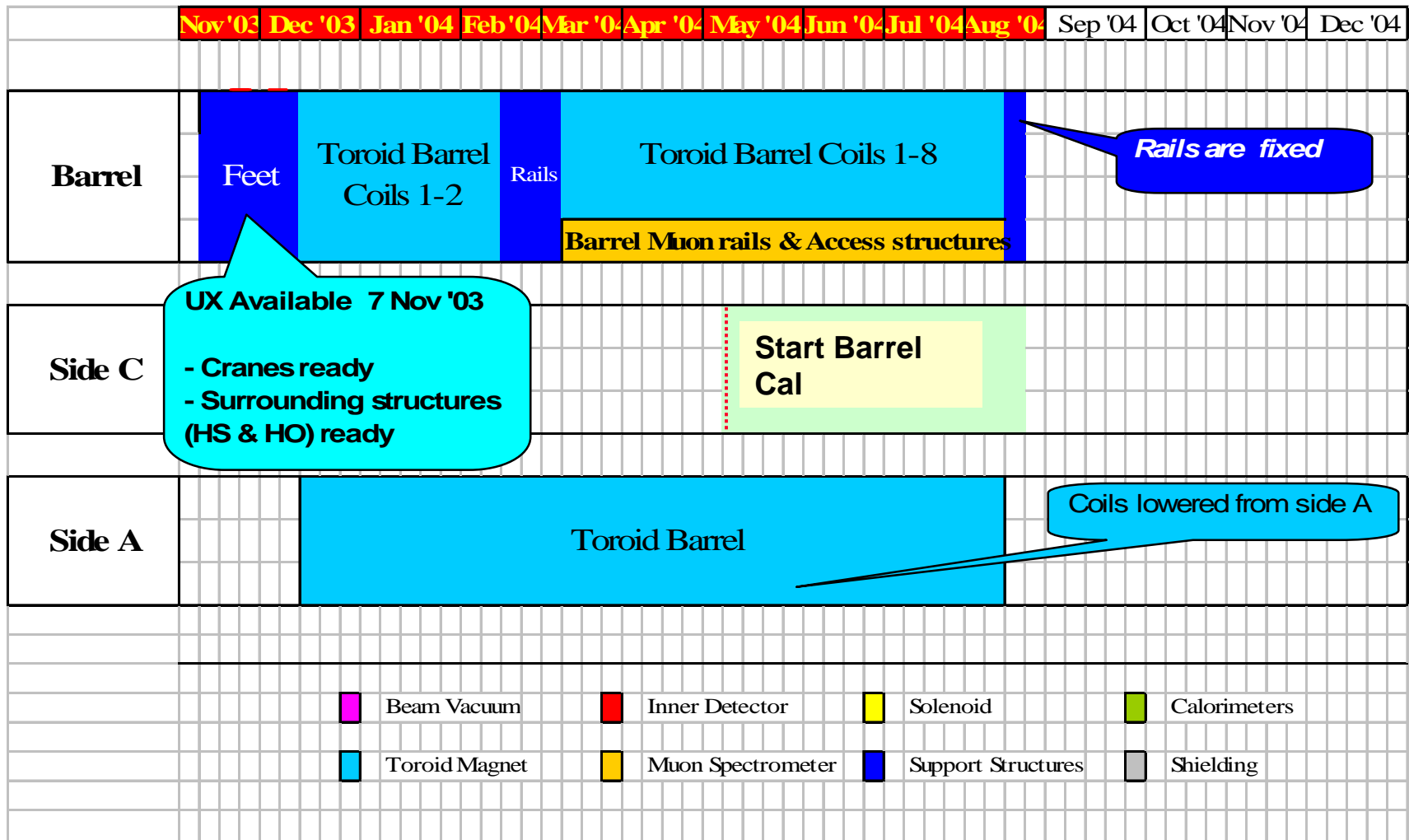
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**ATLAS will start
installation at Point-1 in
April 2003**

ATLAS Installations: Phase I



Feet & Barrel Toroid



Installation Stage II: Barrel Toroid

Barrel Coil integration in the West Hall @ CERN:

Integration I: Cold Mass Integration Start June '02 18 Month.

Integration II: Integration of cold mass in the Cryostats
Start end of '02

Coil Test: Each Coil is tested on the Surface.



B1 : 25m long B1 coil casing



B1 : 25m long cryostat

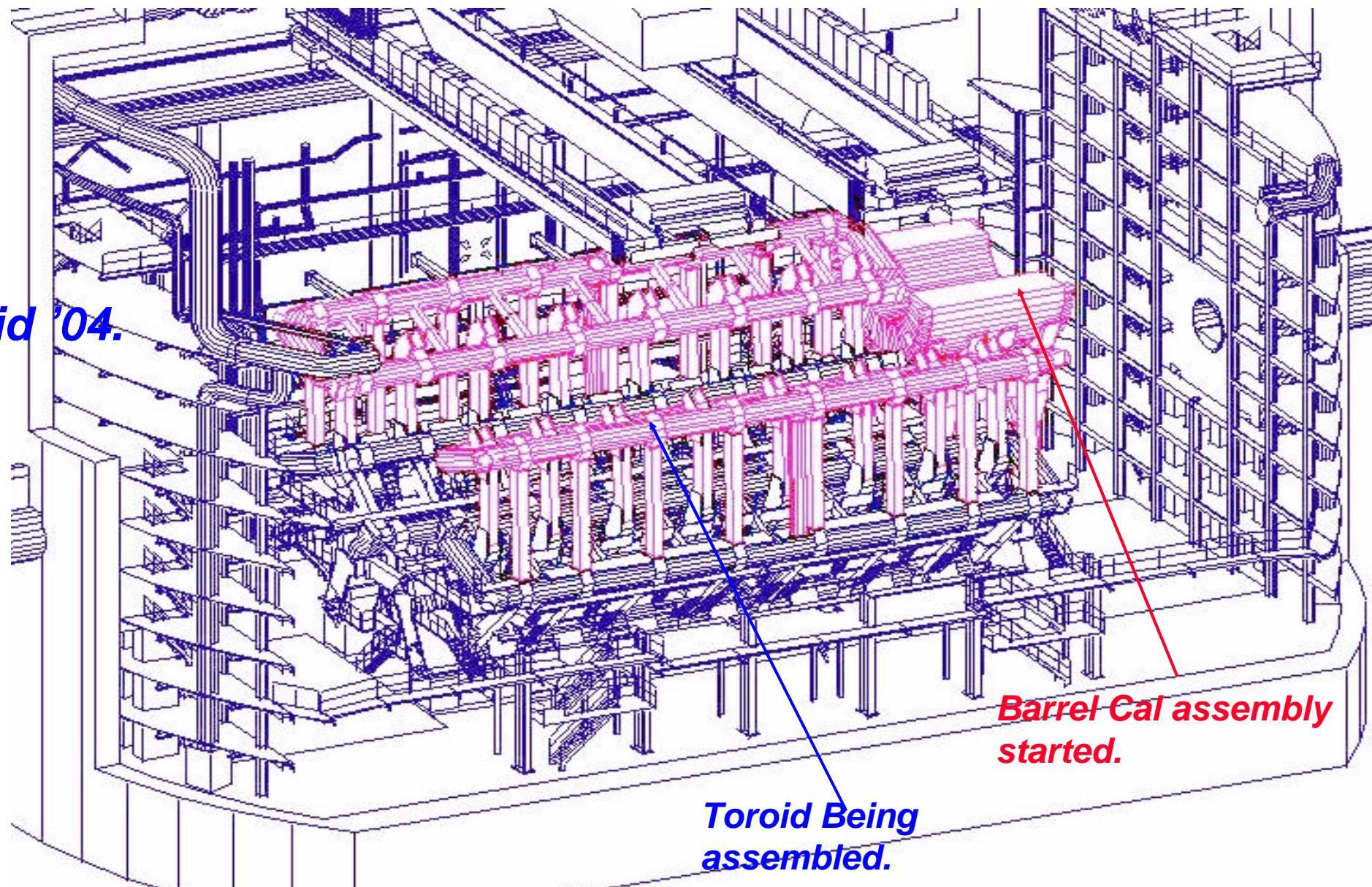
Installation team being formed.

Saclay/CERN(ATLAS)/Dubna

Toroid & Feet/Rail system.

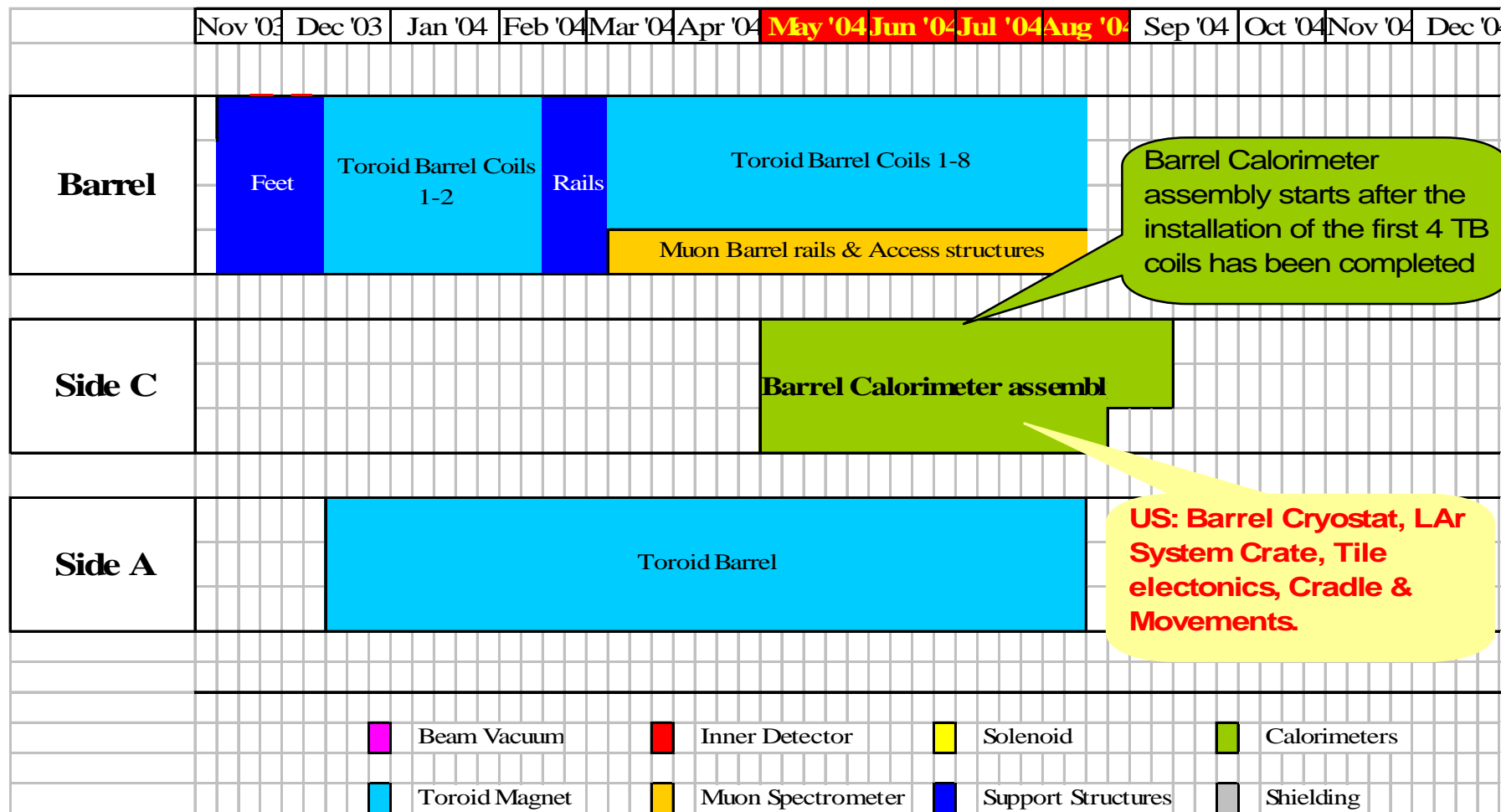
Barrel Toroid & Feet

Mid '04.



Barrel Cal assembly
started.

Toroid Being
assembled.



Installation: Barrel Calorimeter

Tile Staging Area: Building 175

Pre-assembly:

Tile Barrel

EC -C

EC-A.

Validate Calculated Mechanical Structure.

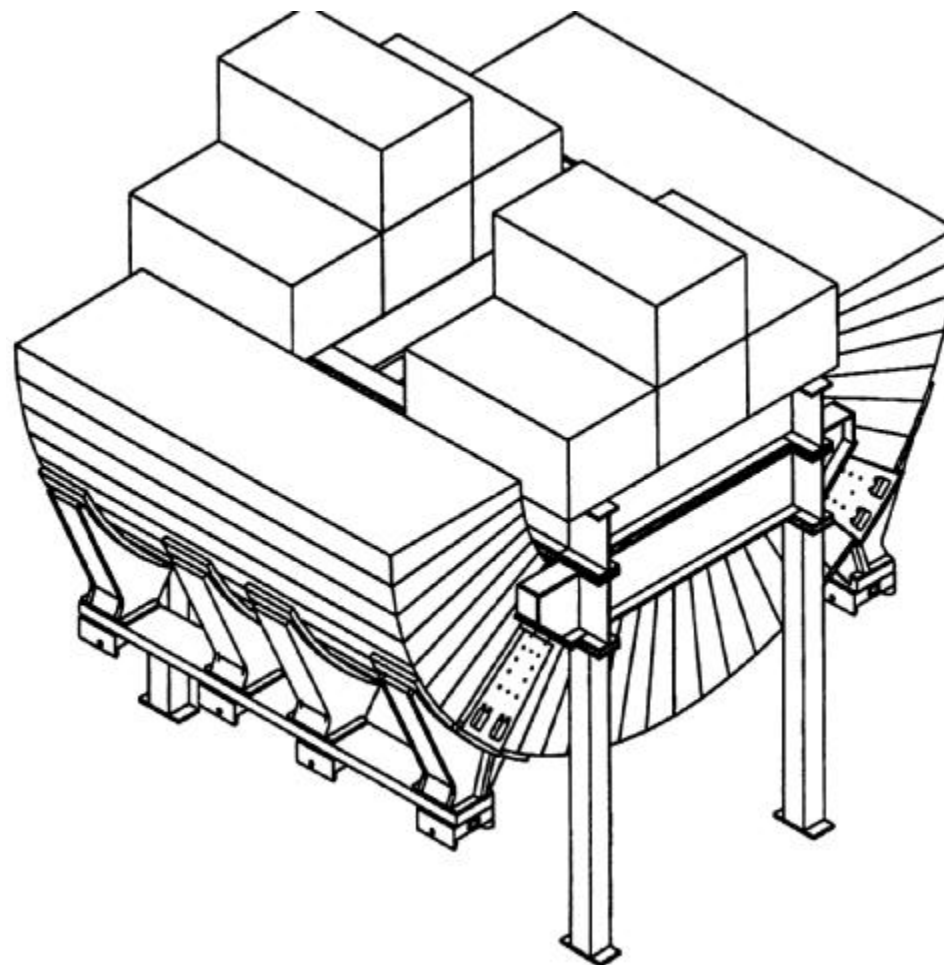
Dummy load representing the LAr Cryostats.

Installation team (Tile + LAr)

Placement in the Hall (Survey)

Movements

Access requirements.



Barrel Pre-assembly with the “LAr dummy load”

Installation: Barrel Calorimeter

Ar Staging Area: West Hall

**Cryostat Acceptance.
FT and Cryogenics connections
Cryogenics and Vacuum tests.**

Start Electronics Installation.

**Barrel EM Structure assembly
started. (Test assembly of three
vertical modules)**

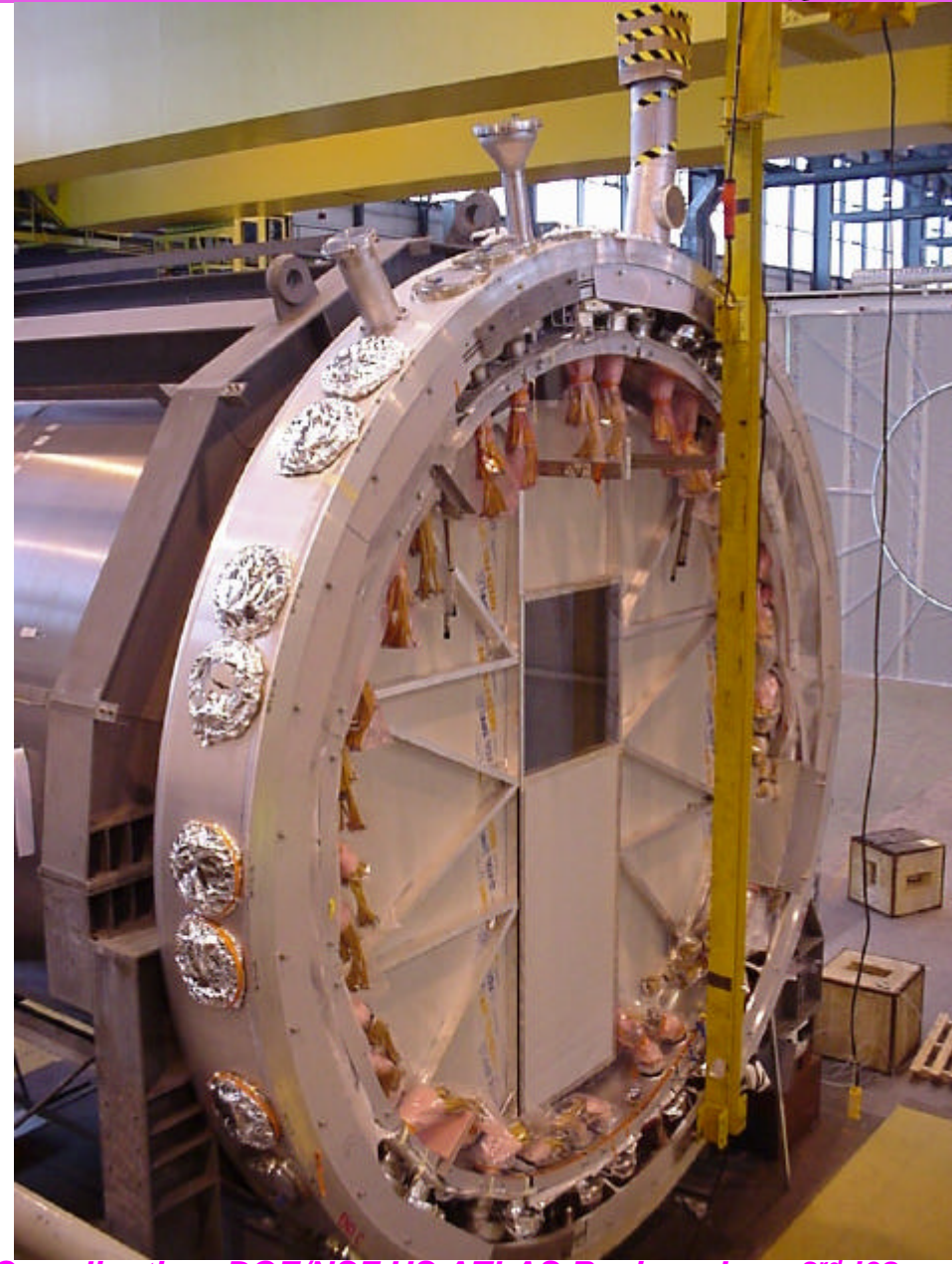
EM Installation in the Cryostat.

Solenoid Magnet Installation.

Cold Test in the West Hall.

Electronics commissioning.

Started in '01

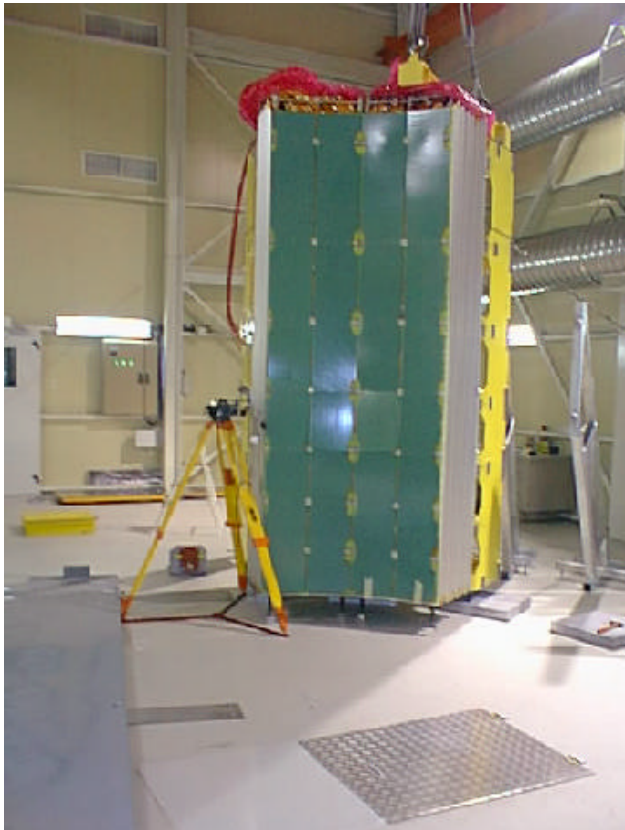


Installations Stage II: Barrel Calorimeter (LAr + Tiles)

Test assembly of EM Modules in West Hall.

Vertical assembly to complete structure.

Installation in the Cryostat '03.

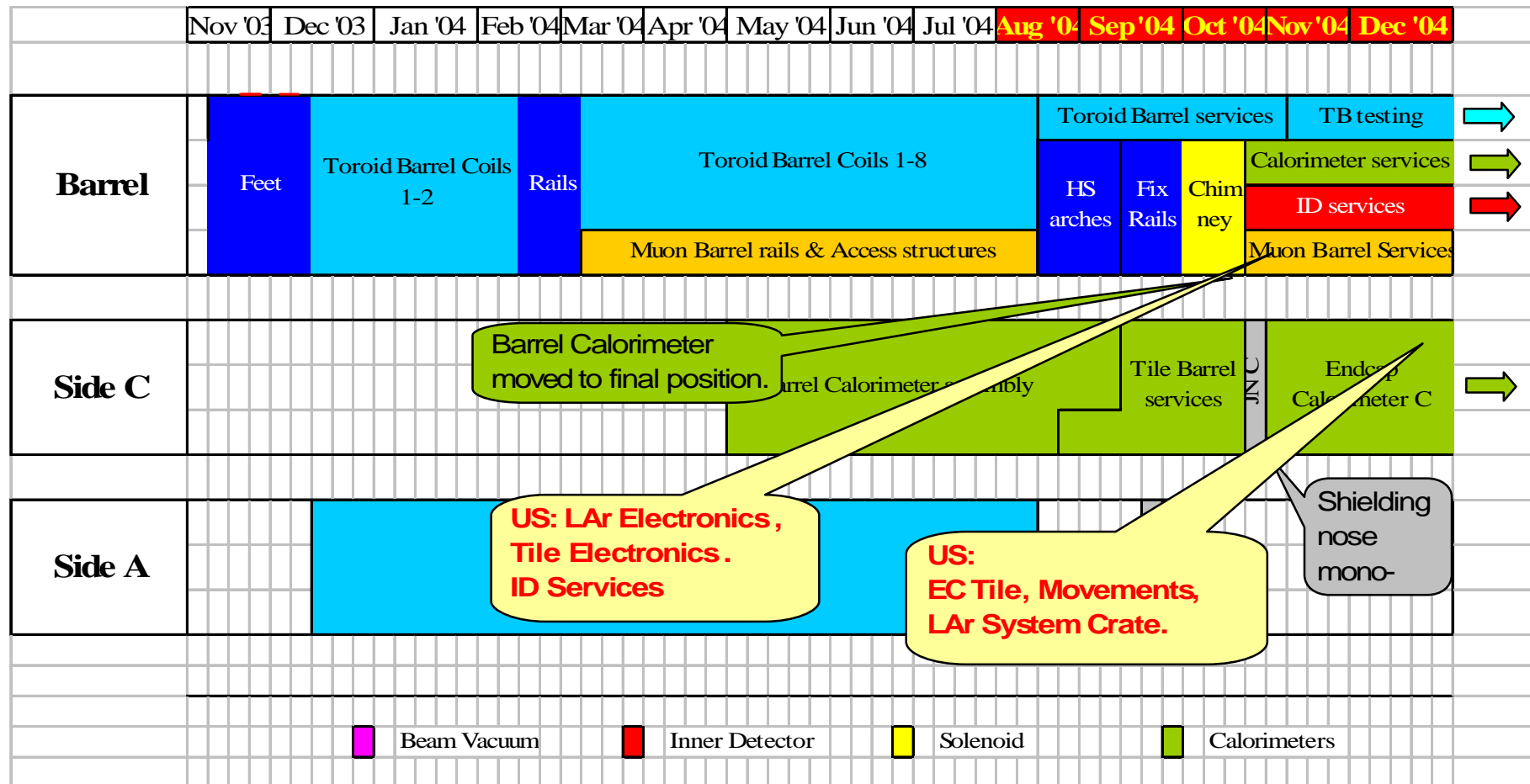


Barrel Solenoid already installed on the Cryostat warm Wall.

ready for installation in the Barrel Cryostat.

Cold Test in West area '04.

Services & Endcap Cal. side C



The LAr Cal :End-caps A&C

LAr EC Staging Area: West Hall

**EC Cryostat Acceptance
FT installations.**

Hadronic Wheel assembly

EM Wheel Assembly

**FCAL Integration to the “tube”
Installation in the Cryostat
Cold Tests**



**EC Had
Ready for
Wheel
Assembly**



**Assembly
table for Had
Wheel.**



**EC EM
Ready for
Wheel
Assembly**

Services Installation

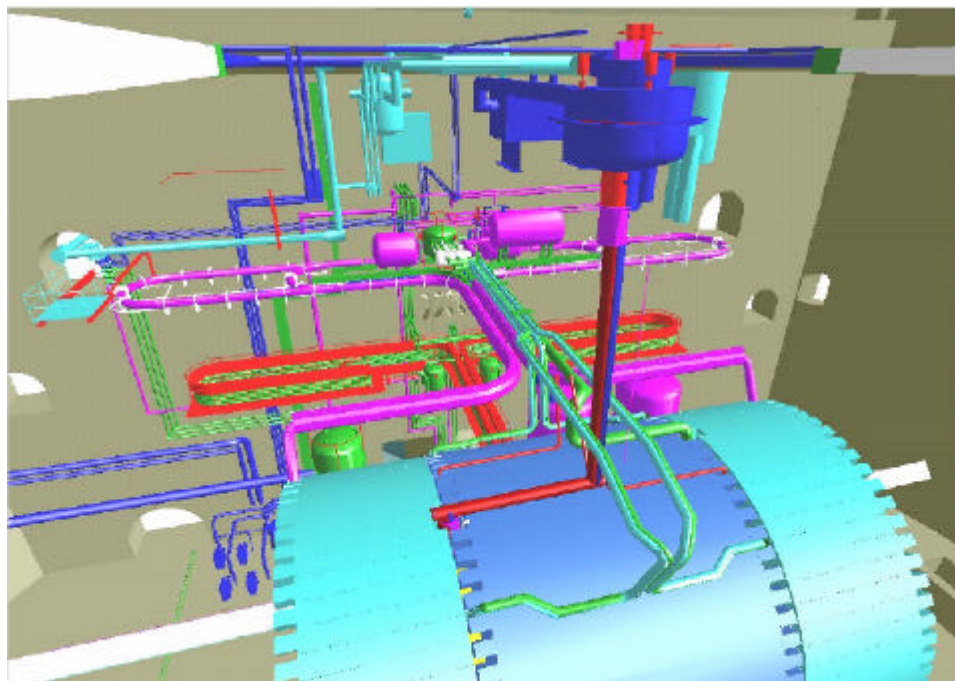
Mock UP in Building 175

1:1 Scale

ID Services, LAr Services

Cooling tests (on-going)

“Leak less system”



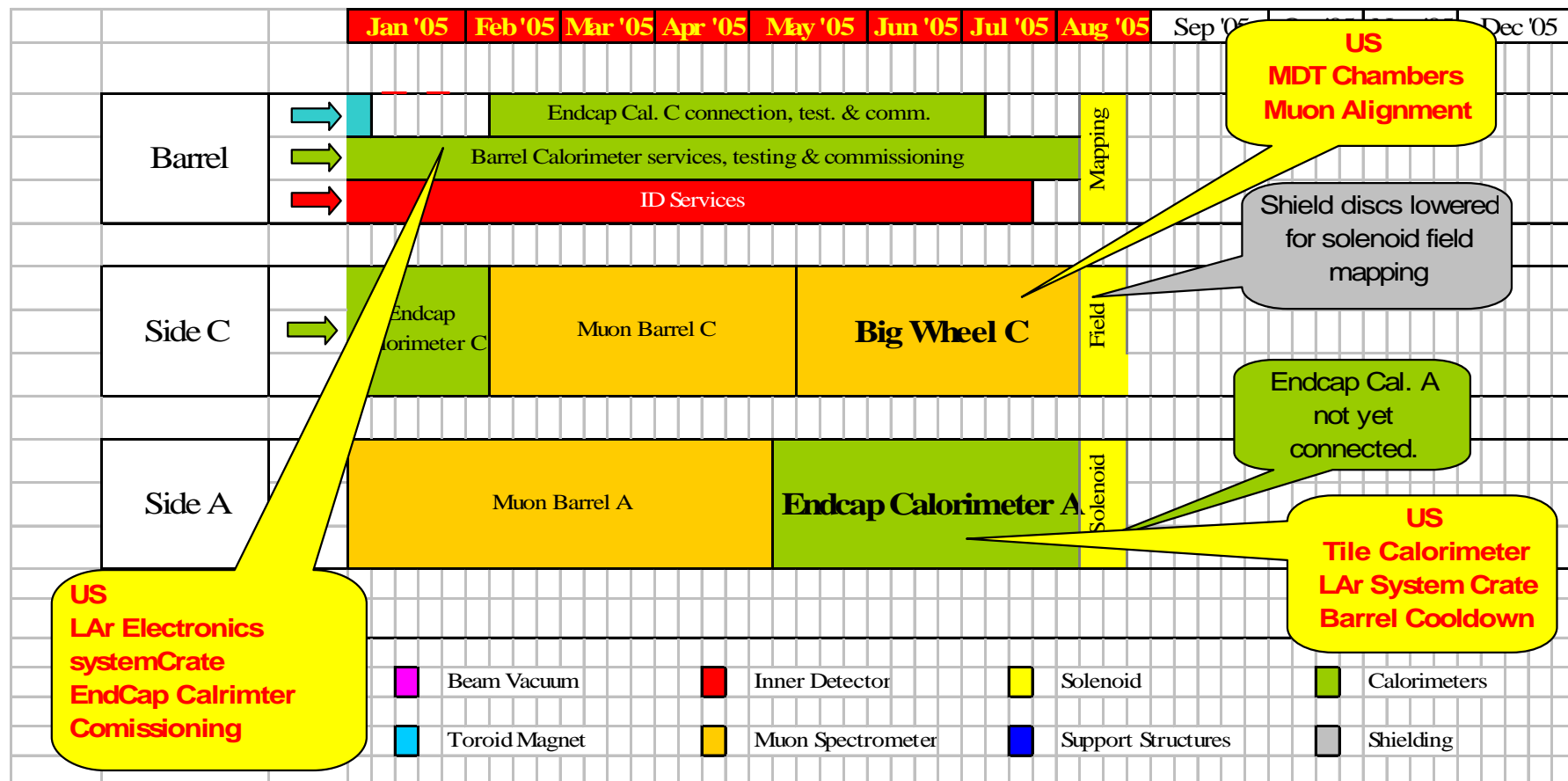
3D Layout Studies

Data Base for all cables and Pipes.

Team being form for actual layout of cables with ST division at CERN.

Barrel Muons Big Wheel C & Endcap Cal

A



Muon: Small & Big Wheels

Staging area under preparation at CERN.

Small Wheel and Big Wheel design being completed. Industrial contacts started.

Big Wheel:

Assembly of 1/16 Sections on surface – final assembly underground.

Four Wheels /Side (3 TGC, 1 MDT)

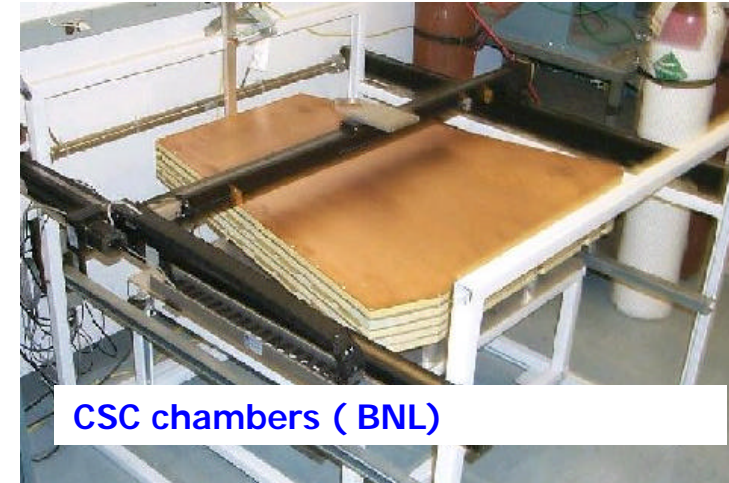
Small Wheel:

Fully assembled on the surface and installed in the JD (Shielding Disc)

One Wheel Per Side:

MDT

CSC's



CSC chambers (BNL)



TGC chambers (Weizmann)



MDT chambers
(Michigan)

Muon: Small & Big Wheel

Staging area at CERN.

Assembly Areas:

MDT: Elect. Inst. & Commissioning

RPC: Commissioning

MDT/RPC Assembly

TGC: Commissioning

CSC: Commissioning

BW: Assembly on Surface.

SW: Full assembly on Surface.

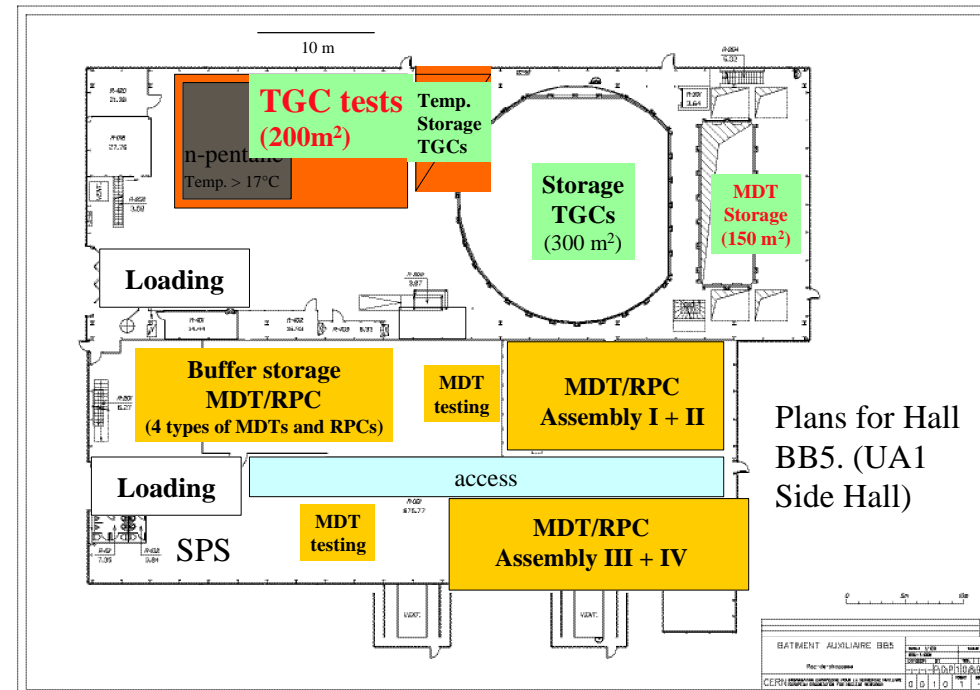
~ 10 Tests and Assembly Lines.

US: MDT, CSC's Big Wheel and Small Wheel. (Start in '03)

Plans for One of the Muons Staging areas in Building BB5.

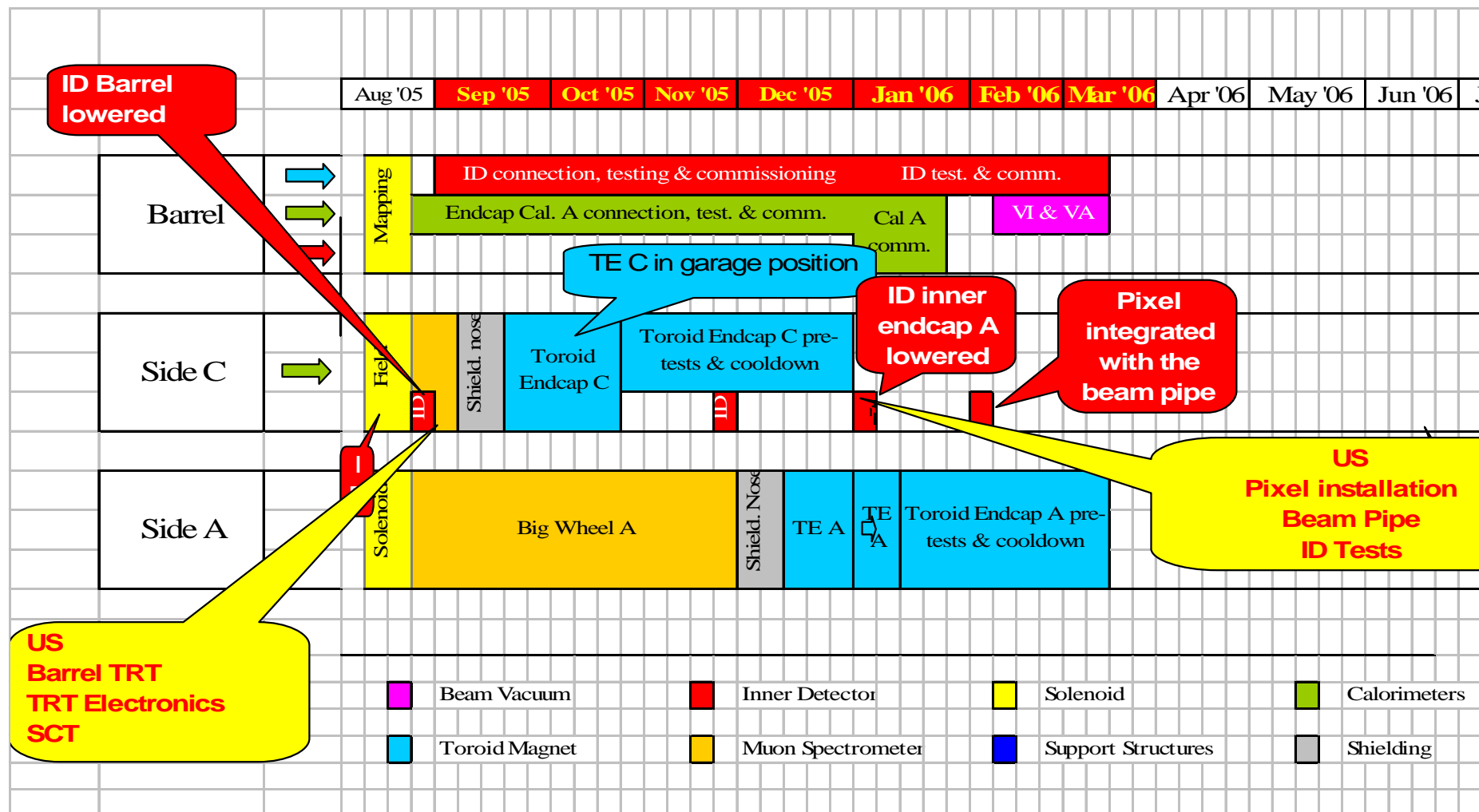
TGC Test Area

2 MDT Test and MDT RPC Assemblies.



Plans for Hall
BB5. (UA1
Side Hall)

Inner Detector & Toroid Endcap A



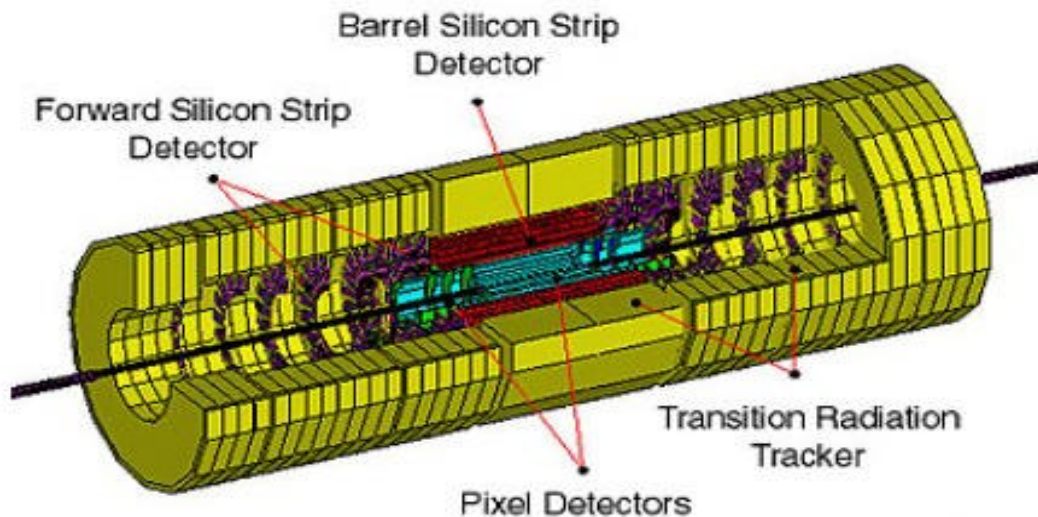
The Inner Detector

“Staging area” for the ID is in a new large clean room facility (SR1 building) near the experimental pit.

Detector assembly '03-'06.

Sub -assemblies: TRT, SCT & Pixels.

1. *Barrel TRT+SCT*
2. *TRT+SCT EC Sides A&C. (Wheels A&B)(X2)*
3. *Pixel+Beam Pipe*
4. *TRT Wheels C (X2)*



*Clean room in SR1
for ID.*

ID Barrel Assembly & Installation

Barrel SCT/TRT Assembly:

Barrel TRT Modules

assembled in the the structure.

4 Layer of SCT assembled.

Pixel Support Tube.

***This assembly has to be ready for
Installation 5/05***



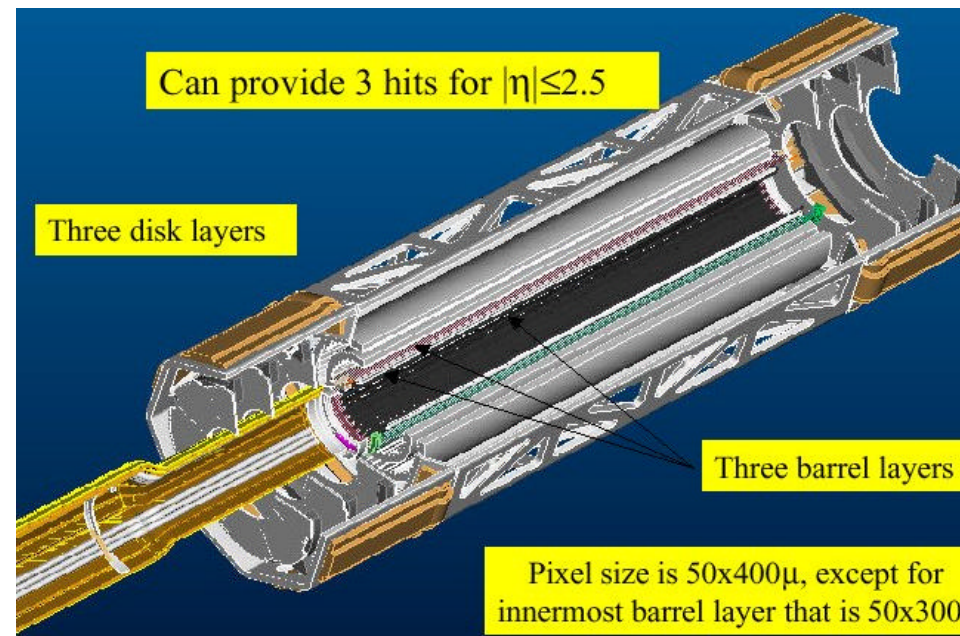
TRT barrel module
construction (USA)

Title:
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Creator:
Designer viewer V5.01
Preview:
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with a preview included in it.
Comment:
This EPS picture will print to a
PostScript printer, but not to
other types of printers.

Pixel VI Beam Pipe Assembly

Pixel Assembly with All its services and Beam Pipe will be assembled on the surface (SR1 Building) in a 7 meter long “transfer Tube” .

The Transfer Tube will be lowered to the Pit and the Pixel and the services will be transfers to the Tube already installed.



~ 140 million detector elements (pixels)

EC Toroid Assembly

- Acquisition of HMA by KFI caused very serious financial and schedule problems (18 months delay Oct 00 - May 02)
- Most technical and qualification problems now solved, but financial/contractual problem not (yet)

Integration in to the Cryostats at CERN. Final Cold tests in the west Hall before installation in the Hall.

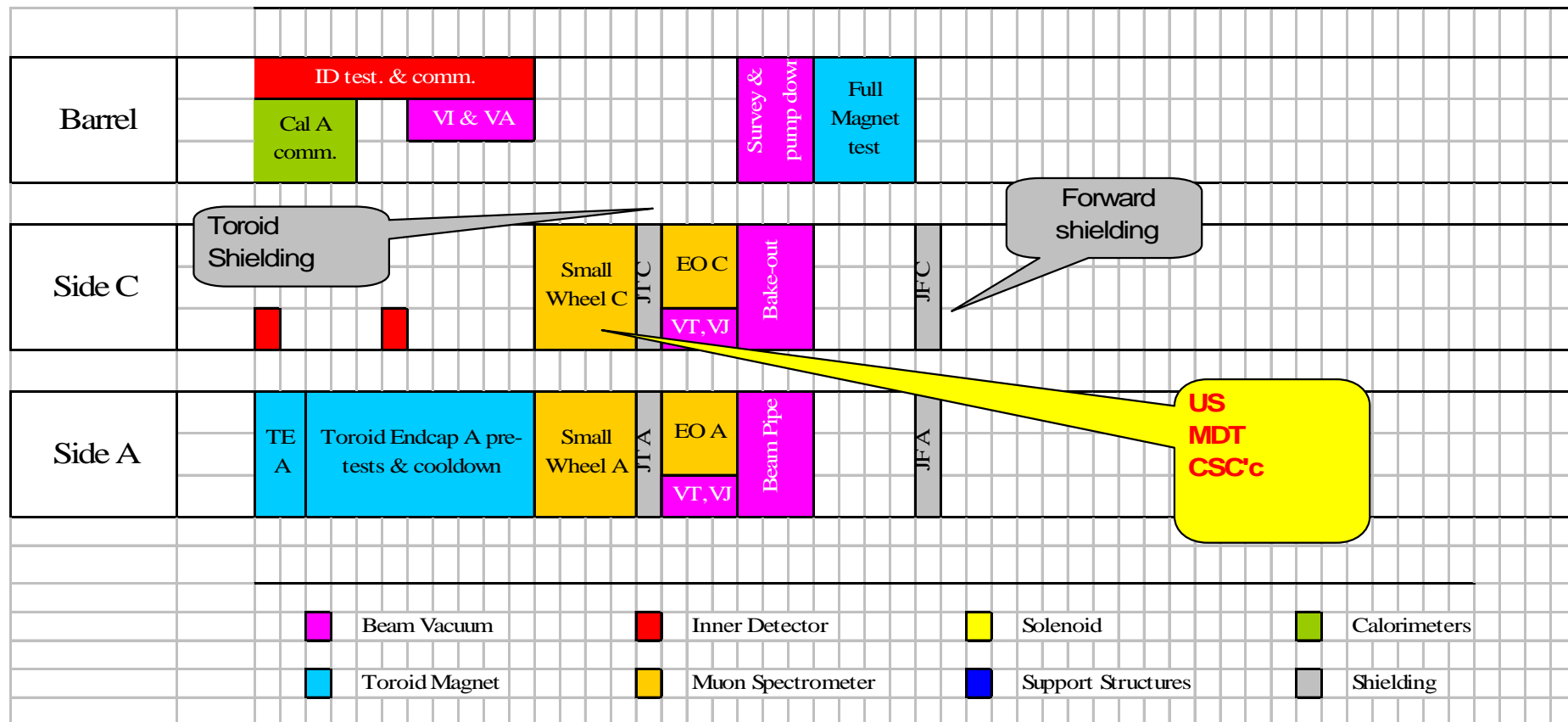
- Cold mass C in Dec 03, TE-C ready in Aug 04
- Cold mass A in Dec 04, TE-A ready in Aug 05

Rutherford/CERN

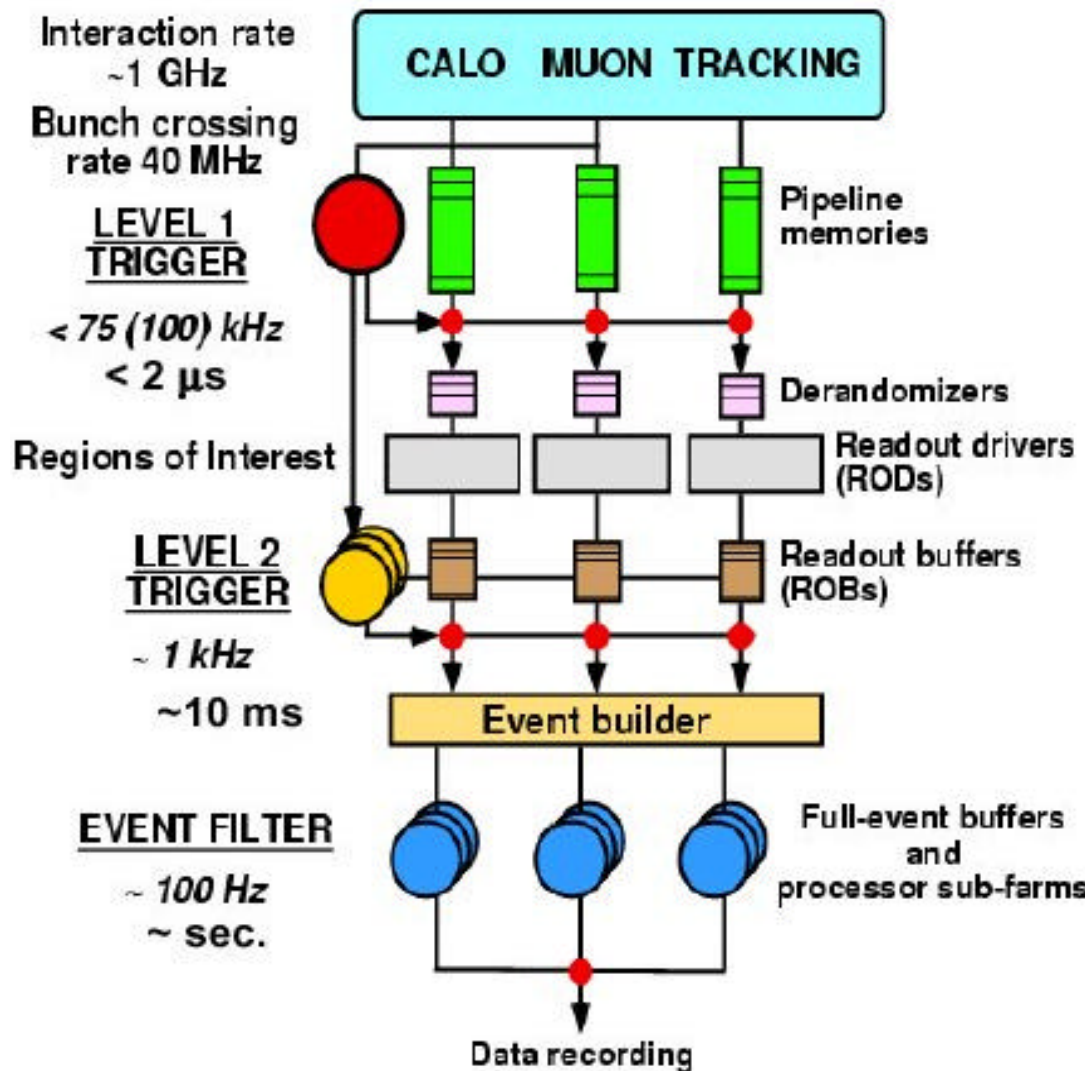


Dummy Coil Winding summer 2000 at Brush-HMA

Small Wheel End Wall Chambers Beam Pipe bake-out & Magnet test



Triggering and Data Acquisition



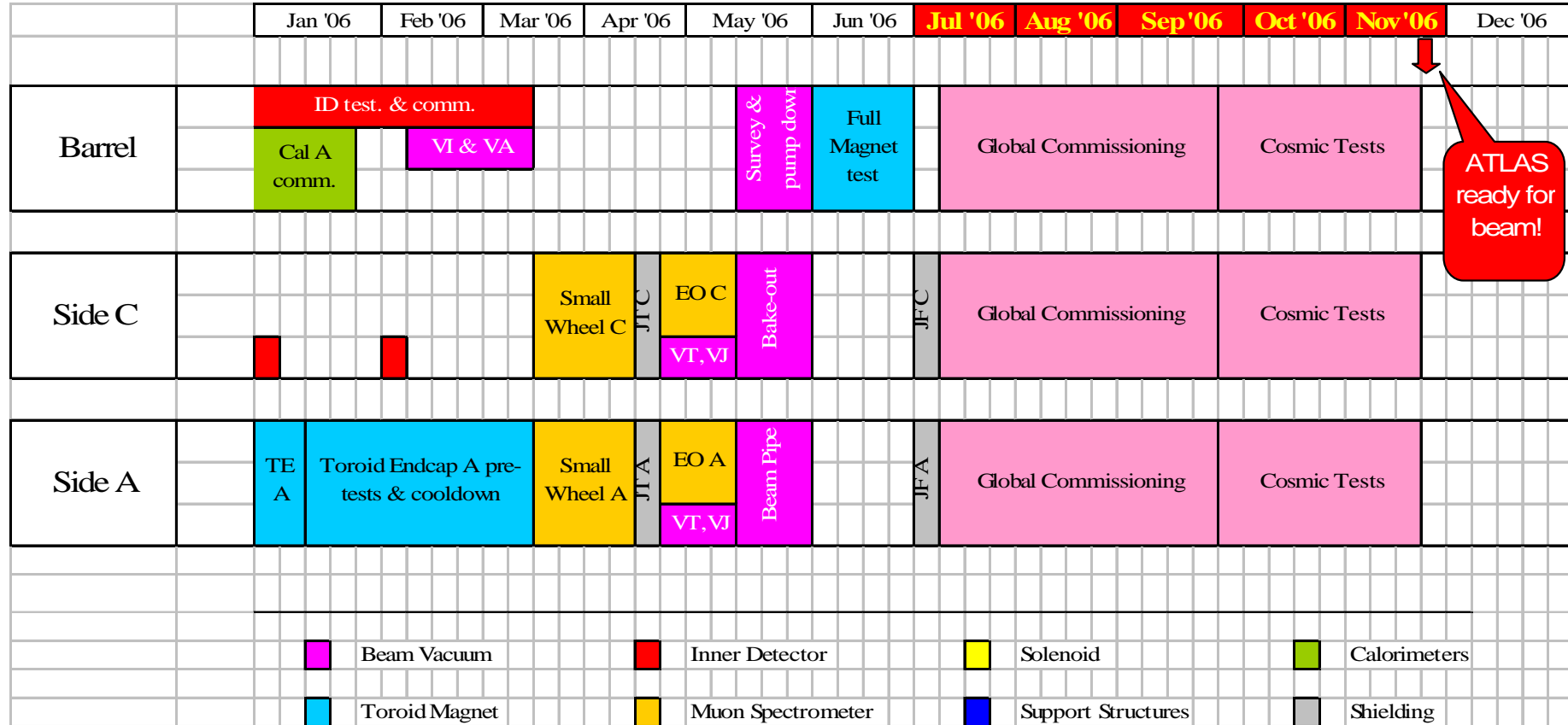
Level I is installed with the detectors.

i.e: Cal Level I will start installation with the Cal.

Skeleton Level II and DAQ will be available for the detector commissioning as the installation progresses.

Exact needs for each detector is now under evaluation.

Global commissioning



Conclusions



TC organization & US Contribution.

*TC is being strengthened – good support and collaboration with CERN ST, EST.
Need is recognized and contributions are increasing (slowly)
US Contribution is limited – but effective. Physicists involvements is increasing.*

Systems “Staging areas” at CERN have started.

*LAr, Tile Magnets staging areas already operational.
ID, Muons areas in preparations.
Need for technical manpower is great. (Total hundreds of people)*

ATLAS installation in the Pitt will start in '03.

*ATLAS installation team is being formed. (ATLAS, ST, EST)
Manpower for installation and commissioning will be needed.*

TC role in the coming years is critical to ATLAS success.

US has a significant role in TC.

US needs to do its “fair” share.